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SOVIET MACHINE BUILDING

NO. 13

SELECTED TRANSLATIONS

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Introduction

This is a serial publication containing selected translations on machine building in the Soviet Union. This report contains translations on subjects listed in the table of contents below.

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1. Roll-Type Separator With a Strong Magnetic Field

/Following is a translation of an article by V. I. Karmazin and V. V. Krutiy in Byulleten' Tekhniko-Ekonomicheskoy Informatsii (Bulletin of Technical and Economic Information), No. 2, February 1960, pages 6-8; CSO: 2900-N/11(1)7

The Mekhanobrechermet /Scientific Research Institute for Mechanical Concentration of Ferrous Ores7 in 1959 has developed, constructed, and tested a new design of the 5SVK roll-type electromagnetic separator.

In the design of its working part (rolls, pole terminals) the 5SVK separator is analogous to the 2VK-5* one, but as a result of the use of a more powerful magnetic system the intensity of the magnetic field in the working gap of the 5SVK separator reaches 16,000-17,000 oersteds, as compared with 12,000 oersteds in the 2VK-5 separator.

The higher intensity and strength of the field are necessary for treating the weakly magnetic ores constituted by fine-grained titanium-zirconium sands and finely ground manganese and hematite ores.

...The prototype of the 5SVK separator was built by the "Kommunist" Plant in February 1959 and subjected to industrial tests at the "40 Years of October" Concentrator Plant of the "Nikopol'marganets" Trust.

Condensed Technical Sepcifications of the Separator

Feeding Width	2,000 mm
Productivity	2-8 tons/hour
Maximal Magnetizing Current	29 amperes
Power Consumption	5.6 kilowatts
Water Consumption	4-6 m^3 / hour
Dimensions (length x width x height)	2,030x1,512x1,693 mm
Weight	7,750 kg

The tests were based on the sands of rake classifiers, isolated from the overflow of washers, in the 3-0 mm size, and on hydrocyclone sands in the 1-0 mm size as well.

2. Automatic Press With a Floating Slide

/Following is a translation of an article by S. M. Nesvit, G. M. Rodov, and L. M. Podrabinnik in Kuznechno-Shtampovochnoye Proizvodstov (Forging and Dye Stamping Industry), No. 2, February 1960, pages 13-15; CSO: 2900-N/11 (2)./

The TKPO Plant in Ryazan has built, according to a design by the Voronezh Special Design Bureau No. 10, a high-speed sheet-stamping automatic press with a floating slide. This machine is designed mainly for punching operations. The drive mechanism is based on the block diagram shown in Fig. 1. The drive is constituted by a crank-arm mechanism.

The normal operation of the blank-feeding mechanism requires that the crank and the connecting rod lie along a straight line in the two extreme positions. The diagram shows that this requirement is observed at specific ratios of the variable magnitudes of the radius of the crank to the length of the connecting rod....

Technical Specifications of the Model A863 Automatic Press

Nominal squeeze	25 tons
Adjustable slide stroke	5-75 mm
Number of slide strokes per minute	200, 250, 270, 335, 400, 500
Width of strip	180 mm
Adjustable strip feeding rate	10-150 mm
Span between guide columns of slide:	
Left-to-right	485 mm
Front-to-rear	255 mm
Power rating of three-speed electric motor	7/9/10 kwt

3. A Single-Crank Inclinable Gap Frame KV 235 Press With a Capacity of 63 Tons

/Following is a translation of an article by V. A. Kopish in Byulleten' Tekhnichesko-Ekonomicheskoy Informatsii (Bulletin of Technical and Economic Information), No. 2, February 1960, pages 12-13; CSO: 2900-N/11 (3)./

The Voronezh Forging-Pressing Equipment Plant has designed and constructed a single-crank inclinable gap frame KV 235 press with a force of 63 tons. This press is designed for punching, bending and limited drawing (see figure).

The frame of the press comprises a single-piece iron casting, with two columns, C-shaped, with two coupling bolts. The open frame with an inclination adjustable to 30 degrees makes it possible to utilize maximally the possibilities of the press stamping space and to remove metal parts and wastes conveniently.

An anvil slab with grooves for fastening the dies is attached to the table of the frame. A special insert is provided in the slab for collecting wastes during stamping. Underneath the press table....
/continuation missing/.

....The press is electro-pneumatically guided. The starting and halting of the electric motor are effectuated by pushing the corresponding buttons on the control board. That board also contain a localized-lighting switch and an emergency "Stop" button. The slide is turned on by two hand levers on either side of the control board, or by the foot pedal. The operating mode of the press can be set for "adjustment," "single stroke" and "automatic travel," by reversing the appropriate switches.

Technical Specifications of the Press

Nominal squeeze	63 tons
Adjustable travel of slide	16-100 mm
Number of slide strokes	80 per minute
Closed-gap height at maximal stroke	400 mm
Adjustment of closed-gap height	80 mm
Distance from slide axis to press frame	310 mm
Dimensions of slide	300 x 400 mm
Dimensions of table	570 x 860 mm
Span between columns	420 mm

Technical Specifications of the Press (cont.)

Rating of AOS-63-8 type electric motor	7 kwt
Dimensions of press:	
left-to-right	1,660 mm
front-to-rear	1,880 mm
height	2,900 mm
Weight of press (excluding parts of the foundations and accessories)	2,870 kg

4. Deeds and Needs of Boilermakers

/Following is a translation of an article by P. Kovrigin, N. Zhadanov, T. Bibikova, L. Belyayev, and Yu. Yegorov in Pravda (Truth), 22 March 1960, page 2; CSO: 2900-N/11 (4)./

...Our Podol'sk Machine Building Plant imeni Ordzhonkidze is the country's principal supplier of large-capacity continuously operating coil boilers for thermal electric power stations. Recently our plant has built boiler assemblies for 150- and 200-megawatt units for the electric power stations of the Urals and Siberia. The drafting of blueprints for a new large-capacity boiler assembly with a delivery of 710 tons of steam an hour, for the Kashirskaya State Regional Electric Power Station, is being completed. Blueprints for a boiler with a delivery of 950 tons of steam an hour, for the Troitskaya State Regional Electric Power Station, are in preparation.

Every worker in our enterprise is aware of the importance of its role to completing the dense electrification of the country. It thus makes the situation worse when we recognize that we have not as yet justified the hopes placed in us. In the last two years the plant has not been able to meet State-set targets. The fulfillment of the plan for the first quarter of this year also is lagging.

What are the reasons for this delay? First there is the low level and inadequate volume of research work. For every serial turbine we usually design and build four types of boilers for various types of fuel. In the last few years we have most often utilized boilers operating on mazut and gas. And we have done so although the trend toward a change in the country's fuel balance toward cheaper liquid and gaseous fuels was outlined as long as several years ago. The Central Boiler and Turbine Institute imeni Polzunov (TsKTI) and the All-Union Heat Engineering Institute imeni Dzerzhinskiy (VTI) have not conducted omnilateral studies f these fuels, and they have not furnished the necessary recommendations to the plants. The institutes pay no attention at all to the study of the fuels from new deposits, and thus we quite often have to design boilers "in the dark" without taking into account the properties of a given fuel; this extends the time and raises the costs of designing.

The lag in boilermaking is particularly notable against the background of the successful development of an allied branch of industry -- turbine building. If today we

fail to face the fact of insufficient boilers designed for the newly built heavy-duty turbines, then we will have to do so tomorrow. For instance, the Khar'kov Turbine Plant is designing a 600-megawatt turbine and is already drawing up blueprints for an 800-megawatt turbine. Nevertheless, the drafting of technical designs of boilers for these turbines has for the most part, not yet been started.

The planning organs have no attention to spare for our branch of industry. This is attested by the fact that boiler building plants experience an acute shortage of designer cadres. According to most modest calculations, the personnel of the design bureau at our plant ought to be increased by at least one-third. More than once we have unsuccessfully petitioned the Gosplan USSR, Gosplan RSFSR, and Moscow Oblast Sovnarkhoz, with regard to this matter. Moreover, we need expert metallographers, welders, technologists, etc. It seems to us that the growing need of our plant for skilled cadres could be partly satisfied by establishing in our enterprise a branch of the evening studies faculty of a power engineering institute.

The designing of new boilers is also being hampered by the lack of an experimental base. For many years we have been petitioning for the construction of experimenting facilities. This problem has been raised at all large power industry conferences. Nevertheless, it still has not been decided and in the meantime, in many cases, boiler defects have to be repaired during the process of boiler assembling.

Considerable difficulties are experienced by the boilermakers because of the lack of the proper grades of steel displaying the necessary heat-resistant properties. At present the following five institutes are occupied with the research and development of new grades of steel for boiler building: Central Scientific Research Institute of Ferrous Metallurgy (TsNIIchermet), Central Scientific Research Institute of Technology and Machine Building (TsNIITmash), All-Union Heat Engineering Institute imeni Dzerzhinskiy (VTI), Central Boiler and Turbine Institute imeni Polzunov (TsKTI), and Ukrainian Scientific Research Piping Institute (UkrNITI). All these institutes are subordinated to different organizations, and therefore their activities are not coordinated by any one.

At present our designers are engaged in drafting the blueprints for a large-capacity boiler with a delivery of 950 tons of steam an hour, designed for a 255-atmosphere pressure and for a 585°C steam superheating temperature. The production of tubes of metal having the necessary properties, for that boiler, has not yet been mastered. Also the proper grades of steels have not yet been determined with regard to the construction of another, already designed boiler

geared for still higher parameters.

The specific operating conditions of boiler installations pose special and exceptionally high requirements to metals. These requirements will increase with the continuing perfection of boiler installations. Therefore it is absolutely necessary to designate a main branch institute and charge it with the responsibility for the construction, development, and industrial introduction of new boiler grades of steel. We also regard it as illogical that the Gosplan USSR, while planning the production of new boiler assemblies, disregards the planning of the production of the appropriate grades of steel for these assemblies.

Why has our plant begun the seven-year period so badly? These two decisive reasons for the underfulfillment of the plan could be named: lack of an explicit specialization of the plant, its excessive overloading with orders alien to its basic production profile, and discrepancies between the production program and the material-technical supplies.

First, let us discuss that specialization. The principal production of the plant is large-capacity boilers and apparatuses for oil refineries. However, year after year, our plans are being expanded with an increasing number of products having nothing in common with our principal production: heat recovery boilers, auxiliary-boiler equipment, and a large number of fortuitous orders which could be executed by any machine building plant. The variety of the plant's products is rapidly increasing. This dissipates the efforts of the plant collective and interferes with its concentration of effort on the perfection of the products within its principal production profile. The sovnarkhoz and the planning organs not only do not act against this, but even, conversely, take the initiative in overloading the plant with ever more variegated orders.

As long as five years ago a decision was taken to specialize all the boiler building plants in the country. At that time our plant was relieved of the duty of producing forced-blast machinery -- but not for long. As soon as we had retooled the relieved shop to the manufacture of other products we had again been obligated to manufacture that machinery.

We wish to state that such a situation is intolerable. It is already necessary during the present year to relieve our plant from such extraneous orders, primarily from the minor and uncomplicated ones whose execution does not require unique equipment and a highly skilled labor force.

Now [let us discuss] the material-technical situation. Last year, especially during the second and third quarters, our plant was not ensured with funds for tube and sheet steel.

As a result the State failed to receive punctually three boilers with an aggregate electric capacity of 350 megawatts. Nor has the situation improved this year. As matters stand now, the metal for the construction of a successive boiler is usually assigned to our plant twenty days before the deadline for the completion of that boiler, although its construction requires not less than four months:

Certain plants are consistently slow in delivering on time the tubes acquired from them with the assigned funds. Thus the Chelyabinsk Tube Rolling Plant (director: Comrade Osadchiy) failed to ship to us even one ton of alloyed tube throughout January and February. The Pervoural'sk Novotrubnyy Tube Plant (director: Comrade Danilov) is consistently delaying its tube deliveries. All the instances of delays and interruptions in deliveries are well known to the Head of the Rosglavchermetsnabsybt /Main Administration of the Supply and Marketing of Ferrous Metal Products, RSFSR7 Comrade Gorbasev and the head of the Soyuzglavmetal /All-Union Main Administration of Metals_7 Comrade Golubev. But they do not take any measures to improve the deliveries.

The suppoier-plants, exploiting our extremely difficult situation, force us to accept tubes which were not subjected to thermal treatment nor freed of scale, etc. This has an adverse effect on the quality of boilers.

In our opinion, the structure of the supply and marketing agencies is unusually complicated and needs revision and definite simplification. At the same time, it is necessary to increase the responsibility of these agencies for the steadiness of the supplies of materials to enterprises.

5. The Technical Progress of Hydroturbine Building at the Leningrad Metal Plant in 1959-1965.

/Following is a translation of an article by G.S. Schhegolev in Energomashinostroyeniye (Power Machine Building), No. 3, March 1960, pages 1-4; CSO: 2900-N/11 (5)./

...The dimensions of a turbine of a given capacity decrease when its speed increases. The diameter of the runner wheel of a water turbine built for the Bratsk GES /Hydroelectric Power Station/ amounts to 5.5 meters. That runner wheel displays high power engineering and operating qualities and it fully satisfies the modern level of technology.

The pressure at which the turbines of the Krasnoyarsk GES should operate is identical with the pressure of the Bratsk GES turbines, and therefore the same type of rotor wheel can be adopted for the Krasnoyarsk GES turbines. Then, considering the 508 megawatt capacity of the Krasnoyarsk GES turbines, the diameter of their rotor wheel will amount to 8.5 meters, and their RPM -- 79.

In their endeavor to reduce production costs in all ways, the designers of the Leningrad Metal Plant have set themselves the task of designing a speedier turbine which could operate at a 508-megawatt capacity with a rotor wheel having a diameter of 7.5 meters. Then its RPM will increase to 90.8-93.6, and, consequently, the dimensions of the generator will decrease. The savings in the costs of the hydroturbine equipment alone will total ~20 million rubles, and if we take into account the reduction in the dimensions of the generator and of the hydroelectric-station building units, the reduction in the lifting capacity of cranes, etc., then these savings will total several hundred million rubles.

...The planned comprehensive research in the Krasnoyarsk GES turbines will serve to establish the possibility of further speeding up their performance. If this problem is positively resolved, it will become possible to increase turbine capacity somewhat without increasing a given diameter. A photograph of a mock-up of a Krasnoyarsk GES turbine is reproduced on the cover of this periodical.

Another trend of contemporary water turbine building, in addition to the increase in the speeds of all types of turbines, is the endeavor to increase the pressures of the speedier turbines. This task is being gradually solved. For instance, as early as a few years ago pivoting-vane turbines were built for pressures of ~30 meters, whereas now pivoting-vane turbines with pressures of as many as 70-80 meters are

operating abroad. Of course, the operating speed of these turbines is lower than that of medium-head ones, but it exceeds that of the assemblies with radial-axial turbines.

The highest pressure for which the pivoting-vane turbines built at the Metal Plant are designed amounts to 32.5 meters at a 90-megawatt capacity.

During this seven-year period the plant will have to supply the new hydroelectric power stations of the Soviet Union with pivoting-vane turbines with a 70-meter pressure and a capacity of up to 70 megawatts.

Radial-axial turbines are at present designed for pressures of as much as 500 meters, whereas previously their limit was a 300-meter pressure. The plant also receives orders for radial-axial turbines designed for operation on pressures reaching 400 meters.

Thus, during the seven-year period, the plant will have to make a great leap forward in solving the problem of increasing the operating speed of machines, raising the pressures of the speedier turbines, and designing turbines of a unique capacity as well.

The Metal Plant has also been commissioned to build horizontal turbines for a number of Soviet hydroelectric power stations, and it is already working on the designing of such machines, in which connection their capacities will be higher than those of the foreign-made ones. The designing of the horizontal assemblies should proceed in close collaboration with the generator plants, while the designing of large-capacity reducers should proceed in collaboration with the plants having the necessary experience in the construction of large reducers.

The endeavor to increase the pressures of pivoting-vane turbines has suggested to designers the idea of creating the so-called diagonal turbines, which are an intermediate type in between the axial turbines with pivoting vanes and the radial-axial turbines with fixed vanes. In these turbines the pivoting vanes are positioned obliquely, which alters the shape of the entire flow duct. It has been suggested that such turbines should displace the radial-axial turbines from the medium pressure range.

One such experimental turbine, with a capacity of 75 megawatts, is to be built by the Metal Plant for the Bukhtarma GES.

For the same purpose -- the shift of pivoting-vane turbines into the high pressure range -- one of the turbines of the Uch-Kurgan GES will be provided with an experimental twin-palm runner in which two vanes lie on a single pivot journal.

During the seven-year period the Metal Plant will have to design such reversible assemblies for large capacities --

~ 100 megawatts.

In the high pressure range, these assemblies will be constituted by special radial-axial pump-turbines, and in the low pressure range, by horizontal axial and diagonal types of turbines having the flow-duct shapes most suited to the reversibility of the direction of the flow of water, these types being the most promising at present.

The low-speed jet-bucket turbines could, according to a new concept be replaced by the so-called jet-ring turbine, which is speedier and can be used in the range of pressures that is not accessible to the radial-axial turbines and not yet sufficiently economical for the jet-bucket turbines.

Inasmuch as during this seven-year period the Metal Plant will have to build jet-bucket turbines for one of the GES'es at which pressure only slightly exceeds the limit of applicability of radial-axial turbines, therefore it would apparently be a good idea to develop the version using jet-ring turbines for that GES.

Moreover, many new design solutions arise during the designing of conventional assemblies.

In 1961 the plant will construct the twenty-fourth consecutive experimental turbine assembly for the Stalingrad GES, in accordance with the proposal and initiative of the Leningrad Division of the Orgenergostroy /All-Union Trust for Power Development/. The blueprints for that assembly were drafted by the combined efforts of five organizations: the Metal Plant, the Orgenergostroy, the Khar'kov Turbine Plant, the "Electrosila" Plant, and the "Uralelektroapparat" Plant. On the basis of the operational experience of many large Soviet-produced turbine assemblies and the design executions of certain foreign assemblies, it became possible to design an assembly making it possible to eliminate the engine room from the projects of new GES'es, and to reduce the height of the assembly, to lighten its weight considerably and to reduce the labor involved in its construction. Considering that a number of design units, and certain rating norms as well, require experimental verification, it was decided to make this assembly an experimental one.

Materials and Shaping of the Parts of Water Turbines

The increase in the unit capacities of water turbine, reduction in their unit weight per kilowatt of capacity, and the achievements in the field of technology and metallurgy are accompanied by changes in the methods of the shaping of parts and in the materials used in water turbine building.

Let us consider a few examples.

A welded spiral chamber with circular cross section is

used in the radial-axial turbines designed for medium pressures (50-150 meters). With increasing capacity and dimensions of turbines the thickness of sheets, executed of conventional carbon steel, reaches such a high extent -- 70 to 100 mm, that it becomes virtually impossible to construct the spiral chamber from them.

For the Bratsk GES turbines the Metal Plant used grade SKhL-4 weakly alloyed steel which made it possible to increase considerably the stresses in the spiral and to reduce its weight at only a slightly higher cost.

Nevertheless, even that /grade of/ steel is not good enough for constructing the spiral chamber for the Krasnoyarsk GES turbines. The Metal Plant is working together with the Gidroenergoproyekt /All-Union Trust for the Design and Planning of Hydroelectric Power Stations and Hydroelectric Power Development/ on the problem of designing a spiral chamber of reinforced concrete. To solve this problem it is necessary to conduct a large number of studies pertaining to both design and research and calculations.

Still, the plant is also developing designs of metal chambers, ribbed and two-layered, and it is investigating new grades of steels with higher yield points.

In recent years weldments have become a very popular replacement for steel castings. This is explained by the relative low cost of rolled stock and by the advances made in welding. Large parts executed of rolled stock by means of welding require small machining tolerances and individual parts such as, e. g., the chambers of turbine runners can be executed with such precision as to dispense with the machining of their working surfaces. The rational laying-out of sheets reduces the consumption of metal by dispensing with foundry waste heads.

Nearly all the large parts of the turbines for the Bratsk GES will be executed in welded form. Most of them will be of rolled stock. The runner will be executed in cast-welded form, and the turbine shaft will be shaped by means of the electroslag method of a forged drum and mold-chilled flanges, etc.

With the transition to welding it is necessary to determine the shape of parts that best satisfies the requirements of the welding process, and the welding itself reveals new prospects for obtaining the most rational shapes of parts from the standpoint of their strength and hardness. For instance, the former shapes of the turbine cover clearly do not satisfy such requirements. At present the plant is conducting large-scale research in new designs of turbine covers.

A good structural material for a number of turbine parts is constituted by magnesium-modified, high-strength cast iron.

Displaying good mechanical properties, it is easy to shape into parts, is satisfactorily machinable, and in a number of cases it can replace carbon steel. Its cost is approximately half the cost of cast steel. Unfortunately, the foundry base of many of the country's industrial regions cannot produce such iron because of the obsolete nature of smelting equipment -- it is necessary to raise the temperature of the molten metal to the proper limit.

However, all the same, this problem has to be solved by our metallurgists. Magnesium-modified cast iron is not only needed for water turbine building, but also could be useful in a number of other branches of machine building. Small isolated plants in our nation cast such iron successfully; therefore it is necessary to utilize their experience in the immediate future.

We have touched on certain problems which have already been, or still are, seriously worked on at the Metal Plant; nevertheless, there also exist other problems which are only beginning to be studied, but which after a time may become the proncipal trends in the utilization of new materials and in the technology of molding and shaping of parts in water turbine building. We have in mind the new nonmetallic synthetics.

The low unit weight, satisfactory mechanical, anticorrosion and anti-erosion properties, and high anti-friction and insulating qualities of these new materials stimulate a well-deserved interest. However, in order to use any material, it is necessary to be quite familiar with its properties and to know how to make a finished part from it. Water turbine builders as yet lack such familiarity and knowledge. As is known, an attempt has been made to produce steamer propeller screws from nylon. This material, judging from foreign information, displays a high strength, enormous resilience and good anti-corrosion properties. Such qualities make nylon suitable for the vanes of the runners of water turbines. So far, however, parts have been made of nylon only by the method of hot casting under pressure and hence in small dimensions. Domestic data refute the high strength of nylon. And yet, nylon is used in making propeller screws which are exposed to high loads and require high strength. Consequently, water turbine builders are tntitled to demand of the chemical industry that it produce nylon displaying the necessary properties. Initially nylon could be tested for use in the vanes of jet-bucket turbines, which are relatively small in size but subject to considerable centrifugal-force loads. The low unit weight of nylon would reduce these loads to approximately one-sixth, and it would facilitate the construction of the turbine runner. The high

plastic properties of nylon make it possible to reduce the strength margin.

As is known, glass plastics display a high mechanical strength; they are executed in the form of sheets. This suggests the question whether they could not be used for, e. g., making the turbine cover?

Water turbine builders are also extremely interested in anti-friction materials which would make it possible to construct bearings operating without lubrication and which would, moreover, bear up under high unit pressures of approximately 250 to 300 kg/cm^2; this would make it possible, in turn, to abandon the very complicated and operationally extremely unwieldy system of the lubrication of all friction surfaces in the mechanisms of the control apparatus. At present the plant has made an attempt to obtain such material. The first bushings made of this material are undergoing tests in the GES;es.

Apparently, the chemists alone cannot cope with the task of introducing new materials into machine building. It is necessary to organize laboratories of nonmetallic materials in plants and charge these laboratories with the task of introducing new materials, developing the technology of the manufacture of parts from these materials, and entering into collaboration with the chemical industry for the purpose of emphasizing the requirements for the materials needed by machine builders and investigating new materials under concrete operating conditions.

Regulation and Automation

It is now many years since the plant has manufactured turbines in automated form, but so far this automation has been confined to isolated single turbine assemblies.

The activation of multiple-turbine-assembly electric power stations, the increase in the capacities of power systems and their integration, and the presence of diverse large-capacity thermal, atomic and hydroelectric power stations within the power systems, have all required station-wide and system-wide automation. For instance, it has become necessary to conduct the automation of the process of the optimal transmission of power within a power system, and to maintain the constant frequency of the system of a GES within the limits of a given irregularity of the GES.

The introduction of station-wide and system-wide regulators, which should be based on computing-resolving machines, has required the designing of such regulators of prime movers as could conduct the regulation not only of speed -- as has been the practice hitherto -- but also of other parameters,

e. g., load, power transmission, acceleration, water flow, etc. Apparently, the electrohydraulic regulator optimally satisfies these needs. The first industrial models of the electrohydraulic regulator have been constructed at the plant and are now undergoing comprehensive tests in the GES'es.

A number of hydroelectric power stations, such as Bratsk, Votkinsk, and others, will be provided by the plant with electrohydraulic regulators.

Conclusion

The presence of a large number of very complex tasks in the plan of technical progress, in its section pertaining to water turbine building -- tasks which have to be solved on a high scientific level -- requires a radical reorganization of all design-research and technological activities.

In effect, the Leningrad Metal Plant is called upon to solve problems which could only be handled by a large scientific research institute, and moreover it has to solve them from the moment of the formation of a new [design] idea until the embodiment of that idea in metal.

The time is ripe for establishing on the basis of the existing design and technological bureaus, and of the plant's own laboratories as well, a scientific research design-technological plant institute.

Such an institute should be provided with better-equipped laboratories, which will require the expansion of the existing and already obsolete laboratories of the plant. It is necessary to fortify the plant with more engineers and research cadres, which could be done easily within the framework of that institute whereas in practice it cannot be done within the framework of the plant.

6. Complete Automation and Mechanization of the Production Precesses of Machining Metals

/Following is a translation of an article by Yu. V. Kolotilova in Mekhanizatsiya i Avtomatizatsiya Proizvodstva (Mechanization and Automation of Industry), No. 2, February 1960, pages 53-54; CSO: 2900-N/11(6)./

The Moscow House of Scientific and Technical Propaganda imeni F. E. Dzerzhinskiy has, in the light of the decisions of the June Plenum of the CC CPSU, conducted several seminars including one on the "Over-All Automation and Mechanization of the Production Processes of Metal Machining."

The seminar was opened with a lecture by Dr. Eng. Sci. A. P. Vladziyevskiy, who shed light on the prospects for the development of automatic equipment during the seven-year period. As is known, the degree of automation of the existing pool of machine tool equipment is characterized by the share of automatic machine tools in that pool. The number of types of automatic machine tools is continually increasing. Thus, while 295 types of automatic and semiautomatic machine tools were manufactured in 1957, in 1956 /1965?/ the machine building industry will manufacture 650 type-sizes of such machine tools. The quantity of automatic and semiautomatic machine tools will also be increased during the 1958-1965 period. Further, Comrade Vladziyevskiy described the paths of the development of means of automation. The contemporary level of these means makes it possible in practice to conduct the automation of even the most complicated metal-cutting machine tools.

While the first automatic lines were of the uniflow kind and consisted of not more than 10 machine tools and sometimes even of as few as two or four machine tools, now the number of machine tools in an automatic line reaches, as a rule, several dozen and even hundreds. This has resulted in division into section, diversification of alignments, and complication of the nature of the conducted technological operations. Automatic lines are built with ready-made means of transport. The future will witness the construction of technologically perfected and still more normalized lines.

The standard automatic lines for machining bevel gears, also designed by the ENIMS /Experimental Scientific Research Institute of Metal-Cutting Machine Tools/ for serial production, will yield a saving of about 500,000 rubles annually.

A report on "The Technical Level of the Contemporary

Technology of Machining Work and the Methods of Assessing It" was read by the head of the Administration of Automation and Means of Production for Machine Building under the State Committee on Automation and Machine Building, Council of Ministers USSR, A. Ye. Prokopovich. The principal factors determining the productivity of the machining process are the quality of blanks, productivity of cutting and continuity of the operational cycle.

Inasmuch as the perfection of the cutting tool is advancing at a much more rapid pace than the replacement of machine tools, the designs of the newly built machine tools should provide for a margin of speed. Automation is an important potential for increasing labor productivity. The index of the quality of the automation of production processes is constituted by the coefficient of the continuity of process, determining the unit productivity of a machine tool.

In his report on "Over-All Automation and Mechanization of Production Processes in Machine Building in the Plants of Moscow, "a member of the Mosgorsovnarkhoz /Moscow City Sovnarkhoz/ Council N. A. Razumov noted that in the production process of a machine building enterprise the expenditures of labor on machining and assembling reach 60-80 percent of the total labor expenditures, and that therefore the perfection of machining technology is of tremendous importance to technical progress in machine building.

The most important and promising ways of increasing the labor productivity of machining consist in the introduction of groups of multi-position automatic and semiautomatic machine tools and continuous-flow lines. Thus, the use of the special 1S-212 group of eight-position machine tools for machining the bicycle connecting rod has yielded annual savings of 274,000 rubles. That assembly has replaced 15 conventional machine tools; instead of 30 workers now only two are needed.

An even greater rise in labor productivity can be achieved by assuring process continuity, introducing automatic continuous-flow lines. Thus, e. g., the use of an automatic line for machining the casings of electric motors has yielded savings of nearly one and one-half million rubles annually. The period of recoupability of such a line is less than two years.

During the seven-year period the enterprises of the Moscow Sovnarkhoz will produce 450 automatic machining lines. The output of multi-position machine tool groups will be tripled, and the manufacture of standardized units will be organized. Assembling constitutes the least mechanized and automated sector of machine building industry. A considerable economic effect in assembling operations will be yielded

by the mechanization of transport operations, the use of mechanized electric, pneumatic and hydraulic tools.

The Moscow /Automobile/ Plant imeni Likhachev expects to install a suspension conveyer of the pusher type. Calculations show that such a conveyer will serve to relieve about 1,000 workers and will yield savings totaling 20 million rubles annually.

Over-all automation is based on the principle of a rigorous, continuous-flow rhythmicity of evolution of processes, declared Dr. Eng. Sci. F. S. Dem'yanyuk in his address.

Continuous-flow methods are applied both in mass and in serial production, and sometimes even in custom production. At present they constitute the most perfect methods of production.

To devise automatic continuous-flow lines it is necessary to perfect production processes and to develop the designs of equipment suitable for incorporation into these lin s.

Of great importance to increasing the output of parts per automatic line is the standardization of production processes.

The principle of the combination of operations is currently a popular one. A high productivity is reached by the simultaneous machining of many surfaces by a large number of tools. Then the machining time of a blank is shortened 10-20 times.

Equipment based on the combination of mechanical-treatment operations will begin to be used in all stages of production (forging, casting, sheet stamping, machining, and assembling).

For forging operations, examples of such machines are the upsetting machines, and for casting operations -- the automatic mixers. However, the greatest applications for such equipment are to be found in the blank machining operations. Particularly popular are small groups of multiposition semiautomatic lathes of the turning drum and spider types. The number of positions in such machine tools reaches 10, and the number of their simultaneously performing tools reaches 100.

Professor B. L. Boguslavskiy read a report on the subject of "The Principal Developmental Trends of Highly Automated Lathes," noting that a fifth of the total output of machine tool planned for 1965 will consist of lathes. He devoted special attention to the importance of increasing the degree of their automation. The variety of highly automated lathes will more than double compared with 1957. The technical characteristics of the automatic and semiauto-

matic lathes are changing. New automatic control systems have been designed (pneumatic, hydraulic, and, particularly, electric drives, in lieu of the mechanical control system, constituted by distribution shafts with cam gears.) Active control will be introduced with increasing frequency. Hydraulic follow-up systems have found widespread application.

The eminent activist in the science and technology of the RSFSR Dr. Eng. Sci. B. S. Balakshin shed light on the problems of the "Automation of Cylinder-and-Cone Grinding Machines and Universal Milling Machines."

A report on the "Automatic and Semiautomatic Attachments for Metal-Cutting Machine Tools" was read by Cand. Eng. Sci. A. N. Malov, who noted that the use of high-speed and automated attachments is one of the means of shortening the time of auxiliary operations.

In the operations with a short machining time it is particularly important to use these attachments, because the share of auxiliary time in such operations is particularly high.

Attachments with pneumatic or hydraulic drive are incorporated into a machine tool so as to form with it a single whole, which is usually utilized in mass or large-serial production. These attachments are also built in the form of independent devices for mounting on the table or spindle of the serviced machine tool, under the conditions of serial and small-serial production.

Further, A. N. Malkov provided a survey of continuous-action attachments, intermittent-action semiautomatic reversible attachments and automatic single-position attachments.

R. G. Yashunskiy (NIITavtoprom) /Scientific Research Institute of the Automobile Industry/ read a report on automatic feeding devices for general-purpose machine tools. He described a number of type-sizes of vibro-drive, on which a bowl with a diameter of 200 or 300 mm can be mounted, the VP-400 vibro-drive for a 400-mm bowl, and the VP-600 vibro-drive for a 600-mm bowl. The NIITavtoprom has also developed a number of methods for the orientation of parts.

Vibration bins find application as a means for feeding parts (with maximal size of 100-120 mm) into machine tools, automatic assembly jigs, automatic control machines, presses, and other machines, and, in addition, as accumulators of parts on automatic lines.

Cand. Eng. Sci. A. N. Zhuravlev described the mechanization and automation of size control during machining, on emphasizing that the techniques of product control are at present lagging behind the level of development of the means of production and technological processes metal machining.

The introduction of the automation of the process of technical control has been limited, and thus this process continues to be a very labor-consuming one. For instance, in the machine shops of certain plants the number of technical control personnel reaches 40 percent in relation to the number of production personnel, and instances occur in which the conduct of control (inspection) is several times lengthier than the conduct of the machining.

The plans for the next few years of the seven-year period envisage the conduct of a number of organizational and technical measures in the field of the mastering of the manufacture of new up-to-date means of measurement.

Considerable design and production experience has been accumulated in the devising of automatic control and measuring devices. In addition to the automatic devices for the control of geometrical parameters, automatic devices have been designed for the control of hardness, resilience, weight, external defects, and other parameters. The automation of quality control has reached its apogee in the bearing industry.

The Seven-Year Plant stipulates the goal of the replacement of the system of technical control based on the passive branding of rejects, as existing in machine building, by a new system, based on an active control which makes it possible to avert rejects, to ensure a stable and high quality of products, to raise labor productivity, and to reduce production costs.

The Seminar had also discussed the problems of the economic effectiveness of automation. Dr. Econ. Sci. A. A. Zvorykin read a report on the "Over-All Mechanization and Automation of Production Processes in Machine Building and Their Economic Effectiveness."

Cand. Eng. Sci. N. G. Latyshev read a report on "Automation of Production Processes and Its Effectiveness in the Serial-Production Plants."

The participants in the Seminar adopted a recommendation stating that while considerable achievements have been made in the automation and mechanization of mass production, insufficient attention is being paid to solving the automation and mechanization of small- and medium-serial production, particularly regarding the utilization of the pool of the older machine tools.

7. At the Automatic Lines Plant

/Following is a translation of an article by A. Shipigel' in Nauchno-Tekhicheskiye Obschchestva SSSR (Scientific and Technical Societies USSR), No. 3, March 1960, pages 10-11; CSO: 2900-N/11 (7)./

During this seven-year period the enterprises of the Moscow (City) Economic Rayon expect to build 400 automatic lines. 145 of these lines will bear the nameplate of the Special Machine Tool and Automatic Line Plant in the Nation's Capital.

The collective of the former "Pod'yemnik" Plant faces a responsible task -- the gradual transition to the manufacture of much more complex and high precision equipment without interrupting production.

The technological refurbishing of the plant's shops will proceed at full steam ahead. High-precision and high - productivity equipment is being installed and the technology of production is being altered. In this, the enterprise's specialists receive substantial assistance from the machine builders of the "Krasnyy Proletariy" and imeni Sergo Ordzhonikidze plants and from the workers of the Special Design Bureau SKB-6.

The local branch of the Scientific and Technical Society of Machine Builders is expected to assist greatly in the re-equipping of the plant and manufacture of new production.

Previously, production /at our plant/ has not required a high precision of machining and of the assembling of units and parts: we had fundamentally built equipment of the fifth class of precision and less often, of the third class, and quite rarely, of the second class.

Now, however, the equipment produced at our plant is seldom below the second class of precision. This is a fairly complex problem. Only highly skilled workers could cope with it.

How was it done? After all, neither the engineers nor the technicians nor the workers, who had previously specialized in electric lifting cranes, had the necessary experience to solve this and many other problems as well.

Accordingly the local council of the NTO /Scientific and Technical Society/ established two sections -- Technological and Design. These sections were given the task of improving the skills of technologists, designers and workers. As a rule, twice a month they debate various signi-

ficant problems of production and technology and draft the related recommendations. The workers of related machine building plants also participate in these debates.

This had aided in setting up properly new production. As early as at the end of 1959 a total of 17 special 6S86 type automatic machine tools had been built; on being interconnected by transport devices they will compose a 6L62 automatic line.

Soon two automatic lines for the lathe machining of outer and inner races of railroad bearings will be built. They will consist of the L43S1 automatic machines built at the Machine Tool Plant imeni Sergo Ordzhonikdze. We are constructing a system of automatic transporting and feeding devices, at our plant, expressly for these lines. Our plant will also build automatic presses for stamping the races and bins-feeders to serve as automatic accumulators for the sealing of the races.

At the same time, the plant will manufacture centerless-grinding machines for outside and inside grinding, for incorporation into automatic lines.

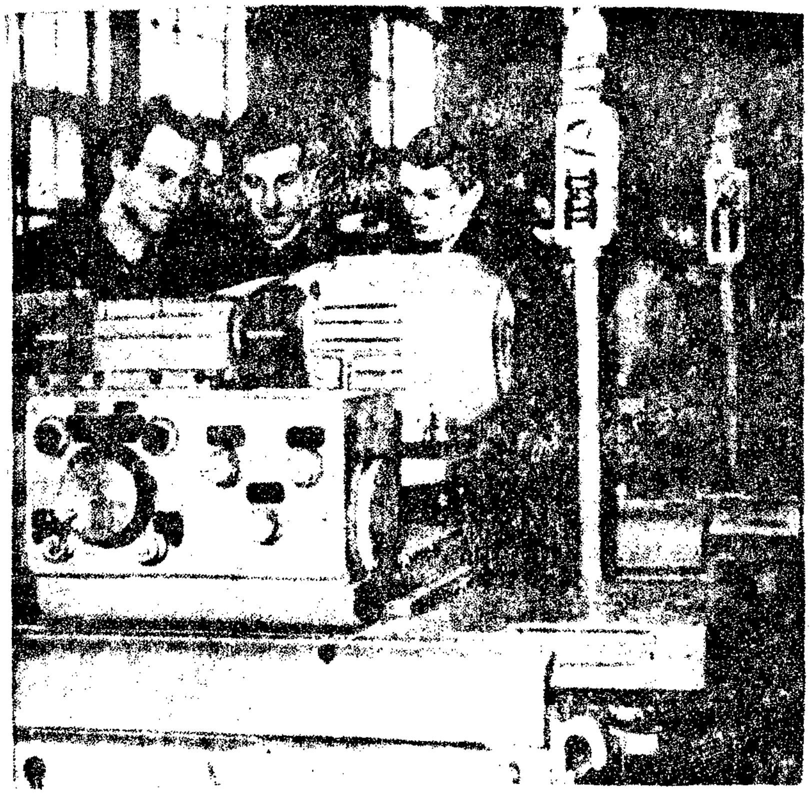
This year, our enterprise will convert from individual lines to the creation of integrated automatic flow lines and automatic shops. The first project of this type is the establishment of an automatic shop for the production of Cardan bearings for the First GPZ /State Bearings Plant/. That shop is of considerable interest. We should like to discuss it in more detail.

The shop is to consist of four flow lines, each of which will constitute automatic lines for the integrated manufacture of a definite type-size of Cardan bearings at the rate of several million units annually.

The 6L51 line will serve to execute preparatory operations -- cutting, clamping, phosphate coating, and saponification of the blank, cold extrusion of a ring having the shape of a hollow-bottomed cylinder.

The 6L52 line, with its special eight-spindle automatic lathes, machines the bottom, face and molded projections on the outer surface of the races. A groove is broached through the outer face, and then the facets and burrs remaining after this operation are removed.

The next line, of the 6L53 type, conducts the heating and cementation of the races in special twin-retort electric heating furnaces and their subsequent cooling to quenching temperature. From the furnaces the races are carried by worm conveyers into a tank where they are quenched in oil. After washing they are cooled to a temperature of 9-10°C (to stabilize their structure), whereupon they proceed to a tempering furnace and later on are cooled



Senior Foremen of Machine Assembling Shop No. 5, Moscow Plant of Special Machine Tools and Automatic Lines, V. I. Glaznev and Yu. E. Rozenfel'd, Discuss With Turner V. I. Koshkin the Question of Changing the Headstock of the 6S86 type lathe. All three are members of the Scientific and Technical Society of the Machine Building Industry.

to room temperature.

Subsequently the races enter the 6L54 automatic line where their outer surfaces are machined on automatic center-less cylinder-and-cone grinding machines. The precision of the machining is safeguarded by the measuring instruments attached to these machines.

Then the races are conveyed to automatic internal grinders which machine the pendulum tracks and the bottom (every line contains 10 to 20 such grinders).

The "flow" terminates in the 6L55 automatic line, where the races are washed, dried in a special automatic machine, and inspected for all their parameters.

Finally, this is followed by the assembling of the bearings, i.e., the insertion of the necessary number of needle rollers and their complementation with a felt lining and caps.

The processes of the branding, wrapping and boxing of the bearings also are automated.

It should be emphasized that not only all production and transport operations but also that the inspection operations have been automated in the lines.

A shop containing 20 automatic lines make it possible to produce several tens of millions of bearings annually.

The heating equipment and the automatic lathes, broaching, grinding and inspecting machines will be built in collaboration with the appropriate specialized enterprises. Everything else -- all the other production equipment and numerous transport devices -- is being built at our plant.

The lines for the automatic shop will be delivered to the First State Bearing Plant this year, and our plant will convert broadly to the production of automatic lines. Therefore, the sections of the NTO Council are now making preparations to solve the problems of the perfection of production and improvement of its quality.

A long-range plan of activities of the NTO has been drafted so as to reflect such important problems as the raising of the technical level of machinery and equipment, devising of improved means of over-all mechanization and automation of production processes, automatic guidance, regulation and control of production, on the basis of the latest feats of science and engineering -- radio-electronics, superconductivity, ultrasonics, radioactive isotopes, and semiconductors.

Attention has been paid to a broad use of modern computers and of high-quality materials as well. The Society's sections intend to foster the introduction of progressive methods of production of parts, in particular

the methods of plastic flow and precision casting, the utilization of weldments (in lieu of castings), and the perfection of the organization of production. Plans exist for a broad employment of the group method of parts machining, for a wider introduction of continuous-flow lines.

8. Republic Conference on Instrument Building

/Following is a translation of an article by N. N. Skvortsov in Priborostroyeniye (Instrument Building), No. 3, March 1960, pages 27-28; CSO: 2900-N/11(24)./

From 24 to 25 November 1959 inclusively the Republic Conference of Workers of the Instrument Building and Radio Engineering Industry of the Ukrainian SSR was held in Kiev.

At the Conference, reports were read on the paths of accelerating the development of the instrument building industry in the Ukraine, including the introduction of pace-setting production processes, the mechanization and automation of instrument building, etc.

The Conference noted that the fundamental conditions for a successful fulfillment of the Seven-Year Plan are introduction of new technology, assurance of a rise in labor productivity; introduction of the mechanization and automation of production processes; specialization of production; improvement of the skills of cadres.

As is known, an enormous role in the fulfillment of the tasks of the Seven-Year Plan should belong to the instrument building and radio engineering industries, which produce means of automation, the radio engineering and transistorized instruments necessary for re-equipping all branches of the national economy on a higher technical basis.

The collectives of the Republic's instrument building and radio engineering enterprises had fulfilled the plan 103.5 percent during the first ten months of 1959. Compared with a corresponding period last year, the volume of output had grown by more than 20 percent.

Perfecting their organization of production and introducing pace-setting progressive technology, the instrument builders of the Kievskiy Economic Rayon had increased their output of instruments and means of automation by over 65 percent in the past two years alone. During that period they had devised more than 100 new instruments and means of automation.

The tasks immediately facing the instrument builders of the Ukraine were formulated at the Conference in approximately the following manner.

It is necessary to:

(1) Discontinue the production of all designwise obsolete instruments and supplant them by new ones;

(2) Convert from the production of individual in-

struments to the production of integrated automatic devices;

(3) Continue the work on the further specialization of instrument building plants;

(4) Reduce to their minimum the cutting operations involved in the machining of patts, on replacing them by operations of automatic die stamping, etc., and, in this connection, introduce more broadly the use of plastics and powder metallurgy, and employ printed circuits;

(5) Improve omnilaterally the quality of the produced output;

(6) Strengthen the design and technological bureaus in enterprises and organize under them scientific-research institutions;

(7) Promote the cause of the organization of a broad /exchange of/ technical information.

The problems of over-all mechanization and automation in the principal branches of industry -- metallurgical, chemical, ore-mining, oil, power, machine building, and others -- necessitate a sizable increase in the pace of development of the instrument building and radio engineering industries, primarily with regard to the output of instruments and devices that are of a particularly great importance to automation, i. e., automatic bridges and potentiometers; guidance mechanisms; gas analyzers; electronic and electronic-hydraulic regulators; control computers; industrial television equipment, etc.

At present, the instrument building industry of the Ukraine is working out:

(1) Equipment for the automation of open-hearth furnaces;

(2) A new system for the automation of production processes on chemical enterprises;

(3) A system for the telemechanical guidance of gas-industry equipment;

(4) Several types of electronic computers.

At the Conference considerable attention was paid to examining the methods of the progressive technology of the machining of instrument parts. At the present stage of technological development the emphasis on cutting in the machining of parts can no longer be viewed as progressive.

And yet, at present, 60 percent of the equipment of the machine building industry is constituted by metal-cutting machine tools, and only 20 percent by forging-pressing equipment.

The share of cutting in the machining operations in individual enterprises reaches 70 percent.

In the Khar'kovskiy Sovnarkhoz 10 instrument building and machine building plants were investigated for the purpose

of an analysis of production technology, and in this connection it was established that out of the total number of parts machined in these enterprises 52 percent are machined on metal-cutting machine tools, 25 percent -- by the method of cold die stamping; seven and 1.5 percent -- are produced from plastics and by the method of pressure casting, respectively; three percent -- by casting into chill molds and precision molds; 0.5 percent -- from metal powders; and eight percent -- by miscellaneous methods.

It was also established that new plastics and synthetics are being used on an ever broader scale in the enterprises of the Khar'kovskiy Sovnarkhoz. In 1959 40 different synthetics in over 150 grades were utilized.

In the first ten months of 1959 the instrument building plants had produced 12 million plastic parts in 180 different varieties with a combined weight of 620 tons.

The plants of the Khar'kovskiy Sovnarkhoz have organized the mass production of powdered-metal parts.

A substantial economic effect is also yielded by the technological processes involving the use of powdered metal in combination with plastics, or cold stamping in combination with automatic welding, or in addition, the methods of reverse extrusion, which increase labor productivity sixfold to eightfold and yield as much as 16 percent savings in metal.

The plants of the Khar'kovskiy Sovnarkhoz also broadly employ drop forging and volume stamping -- not only for fabrication of parts (according to blueprints) but also for the preparation of blanks.

Individual plants in the Khar'kovskiy Sovnarkhoz have reorganized their technological service. The shop technological bureau has replaced the department of the chief technologist as the principal center for the development of new technology.

In particular, technical quality control at one of the plants (an electronmicroscope plant) is conducted by designers from its design bureau.

Instrument builders from one of the sovnarkhozes described to the Conference their experience in the serial production of printed installation circuits.

According to available data, the use of printed circuitry in electric measuring equipment reduces labor input and instrument weight 1.5 to 2 times, and copper consumption -- by one-half.

The weight of the instrument for tuning a television set amounts to 16.6 kg when assembled by the old method, whereas it drops to eight kg when assembled by means of a printed circuit. The consumption of copper per 100 instru-

ments assembled by the old method amounts to 340.4 kg whereas it amounts to only 99.9 kg per 100 instruments assembled upon utilizing printed circuits. In 1960 the L'vovskiy Sovnarkhoz will save as many as six million rubles by employing printed circuits.

The workers of machine building enterprises came out at the Conference in favor of providing the metal-cutting machine tools with means of active /preventive, anti-defect/ control. Interestingly enough, the quality control personnel in the country's bearing plants accounts for 20-30 percent of the number of production workers; 90 percent of the quality control operations are done by hand. In the next few years the instrument building industry should assure machine building with sensors and other devices for active control.

The designing of instruments should be based on the use of printed circuits and semiconductor devices.

To satisfy the demand of industry for instruments, there is a need for a broad standardization of the volume and variety of their output, which can be achieved by introducing modifications into the designs of individual instruments; also, there is a need for a broad industrial introduction of machine tools with programmed guidance, etc.

The Republic Conference of Machine Builders had resolved to turn to all workers of the instrument building and radio engineering industry of the Ukraine with an appeal for developing the Socialist work competition for a pre-term fulfillment of the Seven-Year Plan with regard to the output of instruments, for converting into life the historic decisions of the 21st Congress CPSU.

END